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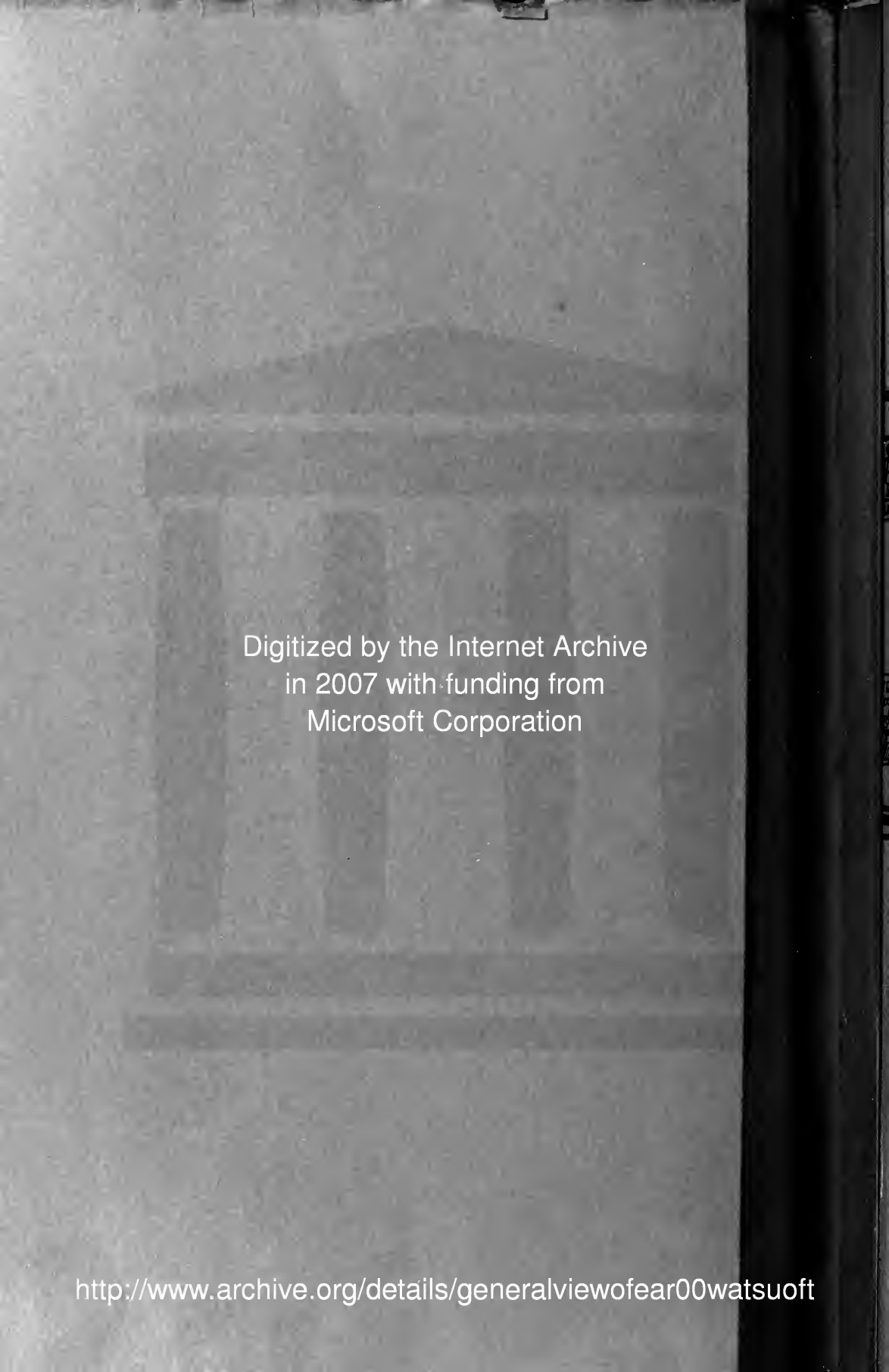
General view of early paper making and how it spread westward.



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GENERAL VIEW OF EARLY PAPER MAKING

AND

HOW IT SPREAD WESTWARD

Mabel M. Watson

To trace the history of paper making, it is necessary to step backwards many thousands of years B. C., for man has always had a deep desire to perpetuate his knowledge and his achievements. Oral tradition may keep alive the memory of great deeds, but accounts of them are seldom repeated exactly as they happened, and men realized that memory alone could not be trusted to preserve accurate accounts of those things worth remembering. So, in these far-off days, men set about finding some surer way of recording their thoughts and deeds. They set stones up. They carved on rocks. They used the bark of trees, and ivory "paper." It is said that the Persians were the earliest recorders. We know that about four thousand years B. C. the Assyrians and Chaldeans were using clay tablets. The clay with its impression was sundried or baked in an oven, and thus preserved.

Later, the skins of reptiles and animals were used, until these in turn gave way to more practical materials, for mankind was maturing, and old ways of recording thoughts and events, provi cumbersome, were discarded and newer and better means were sought.

Egypt offered the next step in the evolution of paper. In the marshes of Lower Egypt, along the Nile, there grew a flag with a triangular stem. It grew to the height of about ten feet. As early as two thousand B. C., a smooth material named papyrus came into use. This was Egyptian paper, and was very durable. Most authorities say it was in use as late as the tenth century. Egypt had a monopoly on papyrus, and did not always accommodate her neighbors when they wished to buy from her. The story goes that Attalus, King of Pergamus, wished to establish a more splendid library than the one at Alexandria. The reigning Pharaoh refused him supplies of papyrus, and he was forced to find a substitute or cease to pursue his plans.[1] He revived the use of skins. Skins of sheep and goats were treated, and again a new writing material mad its appearance. Later, vellum was made in a similar way from the skins of calves.

All these materials were in turn outgrown, and the Chinese, who have played so important a part in many great inventions, gave paper to the world about 105 A. D. Before this date, China had used chiefly slips of bamboo and sometimes wood.[2] Carter says tha the name of Ts'ai Lun is connected in the Chinese mind with the invention of paper. He officially reported the invention to the

1. Butler, Story of Paper Making, p. 17.
2. Carter, Invention of Printing in China, p. 1.

Emperor in 105 A. D., but it is not known that he was the real inventor.[1] The earliest known piece of paper is in the British Museu and was discovered by Dr. Stein in a spur of the Great Chinese Wall It is dated about 150 A.D.[2] The Chinese jealously guarded their secret for many centuries. At the end of the seventh century, the Arabs took as prisoners some Chinese paper makers. These Chinese taught their captors the secret process of their trade, which from then on began to develop at Samarkand. This was about 704 A.D. Paper mills were set up at Bagdad. The Arabs then kept a monopoly on paper making, till they in turn taught their Christian conquero in Spain.[3]

But paper was entering Europe by other routes. The Crusaders were in part responsible. They visited Palestine and Syria and th city of Byzantium. They went to civilize as well as Christianize these ancient lands. How surprised they must have been to find these "infidels" in possession of a great art of which they knew nothing! The trade was growing at Damascus. From Egypt paper was entering Europe through Sicily, and, according to Carter, it probably reached Italy by this route.[4] In the eleventh century the Moors introduced paper into Europe by way of Spain. It passed on to France and the Netherlands. It was Italy, however, during the fourteenth century, that became the source of Europe's paper suppl The first German paper mill was erected at Nuremberg in 1391.[5] Carter points out that although paper started on its journey in 10 A.D., it was not until many centuries afterwards that its manufacture spread in Europe. It was the advent of printing from movable type in the fifteenth century that created the need for cheaper writing material. The use of paper became more general, and the development of a notable industry began.[6]

In the thirteenth and fourteenth centuries, the art of watermarking developed in Italy. The watermarks were connected with mu that was interesting. In the time of Charles I, the "fool's cap" was substituted on paper for the royal arms, and Henry VIII of England, abo ut 1540, is said to have used for his private correspondence a paper whose watermarks represented a hog with a mitre. This was to show his contempt for the Pope.[7] The paper makers generally used marks to distinguish their paper from that of other makers. Some old names are still in use, as is the case with"fool cap" which denominates paper of a particular size.[8] Modern watermarks show the manufacturer rather than distinguishing the paper itself. For example, the crane designates paper made by the Crane A watermark is made by means of a raised pattern on the mould. Because of this pattern, less pulp lodges on the mould at that point, and the paper is consequently thinner. When dry, the pattern may be clearly seen.[10]

1. Carter, Invention of Printing, p. 3.
2. Carter, Invention of Printing, p. 5.
3. Butler, History of Paper Making, p. 22.
4. Carter, Invention of Printing, p. 100.
5. Carter, Invention of Printing, p. 101.
6. Carter, Invention of Printing, p. 101.
7. Butler, History of Paper Making, p. 96.
8. Butler, History of Paper Making, p. 97.
9. Butler, History of Paper Making, p. 97.
10. Cross & Bevan, Paper Making, p. 234.

Dard Hunter says that there is some uncertainty as to the exact methods used by the early paper makers. He says that the art as it was practiced in the fifteenth century is fairly representative of methods employed in the preceding centuries.[1] For this reason, the process of that century is here given.

A wat-man or dipper stood on a platform in front of the vat, which was just a round wooden tub, bound with hoops. He grasped the mould firmly and dipped it, in an almost perpendicular position, into the pulp.. When completely submerged, he lifted it out horizontally from the vat. The mould would be covered with fibrous material. The vat-man shook the pulp on the mould from left to right and up and down. By this motion, the fibres crossed and dispersed equally on the moulds. The deckle or frame was then removed. He passed the mould to the "coucher," while he himself repeated the process.[2] The deckle was a movable frame made to fit the mould, and extended somewhat above its surface. The mould was covered with wire cloth. The coucher turned the mould over, depositing the wet sheet on a piece of felt. He kept on until a number of sheets between felt were obtained. When a "post," (a pile of six quires), of paper was ready for the press which expelled the moisture, a bell was rung to summon all the workers in the mill. The press was massive and cumbersome, and everybody had to lend a hand at turning the screw of the press by means of a long, wooden lever.[3] After the removal of the paper from the press, the next step was the drying.[4] Four or five sheets called "spurs" were dried together to avoid wrinkling. They were dried in drying lofts, and were afterwards "sized."[5] Dard Hunter says that the Chinese used starch as a size as early as the eighth century, and that its use continued till the fourteenth century, when animal glue was substituted. The paper was then taken to a "saul," or that part of the mill where it was surfaced and prepared for transportation. The earliest method of getting a smooth surface was by rubbing the sheet of paper with a glossy stone.[6] In the early years of printing, paper was not cut, the sheets being printed upon in the original size, though often the deckle edges were trimmed off.[7] It is thought that the Chinese mould was a simple bamboo frame over which was stretched a closely woven piece of cloth.[8] As the first water marks (about 1270) were formed of wire, it is supposed that metal as covering for the mould was used before that date.[9]

The Chinese used a vegetable fibre, the mulberry bark and fibres. The original method of reducing the materials to pulp was by placing them in large wooden or stone mortars, and pounding the

1. Hunter, Old Papermaking, p. 13.
2. Hunter, Old Papermaking, p. 13.
3. Hunter, Old Papermaking, p. 18.
4. Hunter, Old Papermaking, p. 20.
5. Hunter, Old Papermaking, p. 21.
6. Hunter, Old Papermaking, p. 23.
7. Hunter, Old Papermaking, p. 104.
8. Hunter, Old Papermaking, p. 40.
9. Hunter, Old Papermaking, p. 43.

fibres with a wooden pestle. Later, the Arabs used the trip hammer. The trip hammer acted in the same way as the hand mallet. The workers, by treading on the end of the bar, caused the hammer to fall on the pulp. A stamping machine was developed in Spain in 1151, and was run by water power. At this period cotton and linen rags were both used.[1] The Dutch did not welcome water power machines in a country where wind was the power used, and the Hollander machine developed much later - about the seventeenth century. After the "Hollanders," the old stampers disappeared, and today, in general construction of machinery, the old Dutch idea is still followed through.[2]

England appears to have been most tardy in developing the paper industry. It began in America about the same time that patents were taken out in England. In 1690 the first American mill was built by William Rittenhouse in Pennsylvania.[3] The industry spread very rapidly. In 1776, so keen was the appreciation of the paper industr that paper makers were exempt from military service, and it was an act of social service to preserve the rags for the mills.[4]

Paper making machines have increased the output of paper enormously, and have done away with a fruitless consumption of time. The principle is this. Instead of using moulds and felts of limited dimensions, an endless wire gauze receives a constant flow of pulp, transfers it to an endless felt, and within a short space of time, paper carefully wound on a roller comes out at the other end of the machine.[5] In about 1804 the Fourdrinier machine was perfected to a high degree, and the simplification of paper making was achieved.[6] Present day machines differ little in principle from the original Fourdrinier.[7]

The process of papermaking remains today in principale as it was in the early days. Until the close of the eighteenth century, papermaking was chiefly a hand process. Today, paper is wholly machine made, except for a few mills that are still "hand-making" paper as a luxury. All Bank of England notes are printed on hand made paper, three edges of every note being rough. Two notes are made from one sheet.[8] Paper for very elaborate editions and some special drawing papers are still hand made.[9] Maddox says that in some cases where high grade paper is needed, cutting of rags is still done by hand, though most mills perform rag-cutting by machinery.[10]

Paper making has been an art of enormous importance to society. It has facilitated - in equal share with printing - the spread of knowledge and education throughout the world. The process was slow

1. Hunter, Old Papermaking, p. 29.
2. Hunter, Old Papermaking, p. 34.
3. Butler, History of Paper Making, p. 29.
4. Butler, History of Paper Making, p. 36.
5. Herring, Paper and Paper Making, p. 41.
6. Butler, History of Paper Making, p. 43.
7. Cross & Bevan, Paper Making, p. 234.
8. Butler, History of Paper Making, p. 43.
9. Cross & Bevan, Paper Making, p. 234.
10. Maddox, Paper, Its History and Sources, p. 39.

in the old days, but so greatly have we speeded up the tempo of our industries, that some one has said it is now possible for th proud giant swaying fearlessly in the forest today to be stacked in uniform little heaps of paper on the shelves of warehouses tomorrow.

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5. Carter, F. C. The Invention of Printing and Its Spread Westwa Columbia University Press, New York, 1925.

6. Cross & Bevan, Paper Making, Span & Chamberlain, New York, 19

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